



FACTORY EARTH

Making Products From Earth Materials

Ages: 8+ Players: 2-4

To win: Gain 12 product points.

Materials:

- Game board: download at:
landsat.gsfc.nasa.gov/ESW2020
- Raw Material tokens and Product cards
- Player pieces - one per player
- Manufacturing Costs chart
- Disaster Spinner
- Paperclip and paper tack or pencil
- One six-sided die

Assembly instructions: Cut out the Raw Material tokens, Product cards, and the Disaster Spinner. Make the spinner by attaching a paper clip to the center of the spinner with a paper tack (or hold in place with a pencil so the paper clip spins freely). Place the Manufacturing Costs chart near the board for everyone's reference.

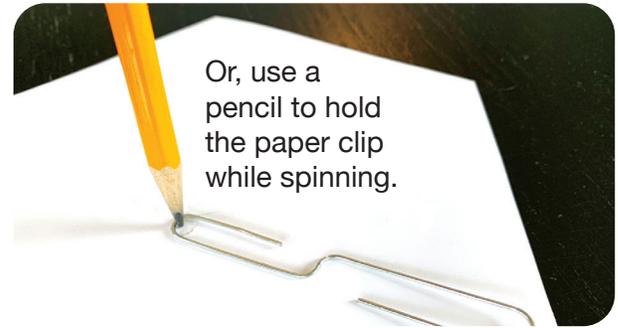
Disaster Spinner assembly instructions:



Insert paper tack through the center of the spinner.



Unfold a paper clip and hook around the paper tack so the clip spins freely.



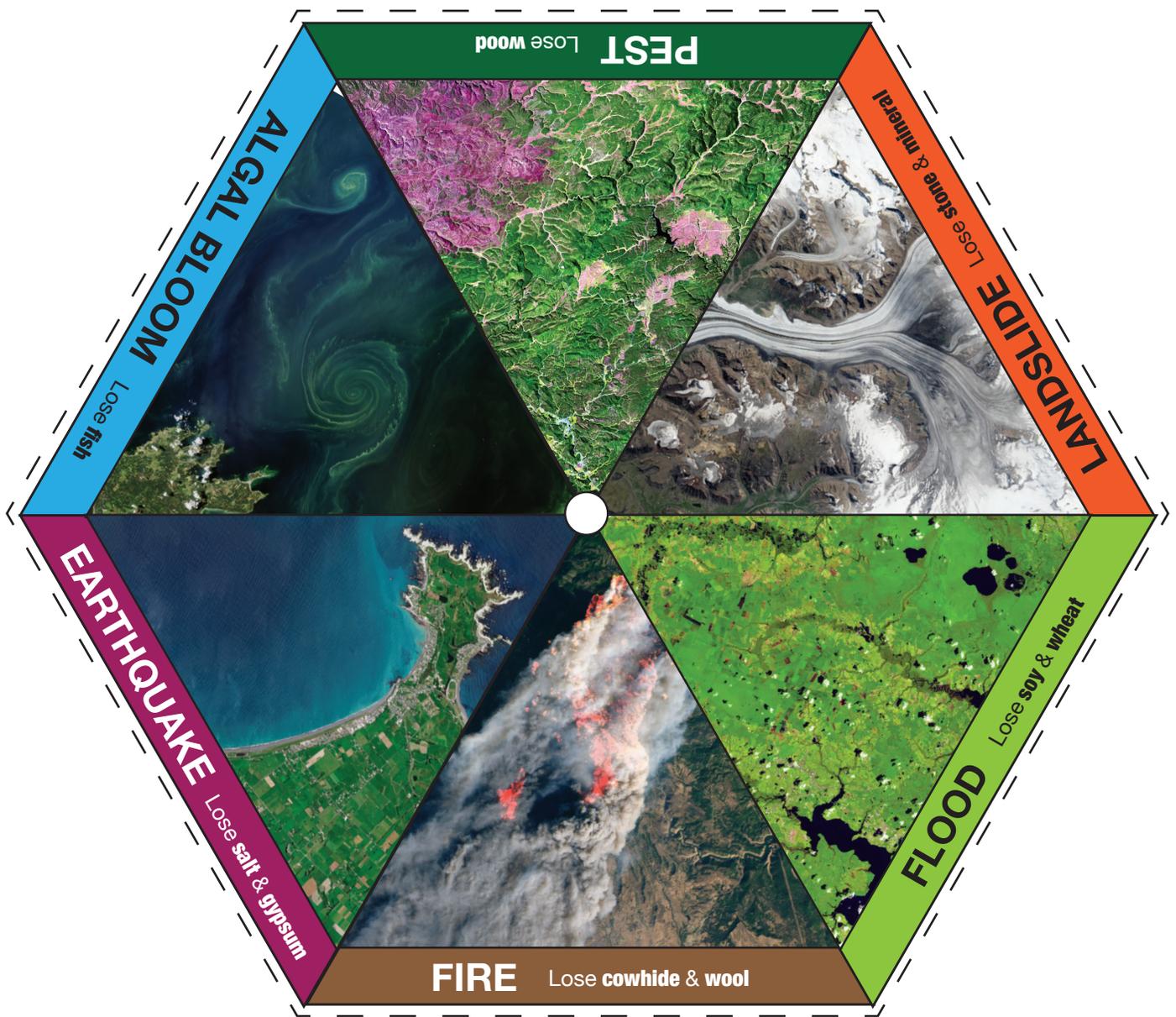
Or, use a pencil to hold the paper clip while spinning.

Objective: Collect raw materials and manufacture products at factories to earn points.

Setup: Stack the Product cards on their matching factories and place the supplies of Raw Material tokens on their matching resource descriptions. Each player places their piece on any resource hexagon (hex). Players may not occupy the same hex.

To play:

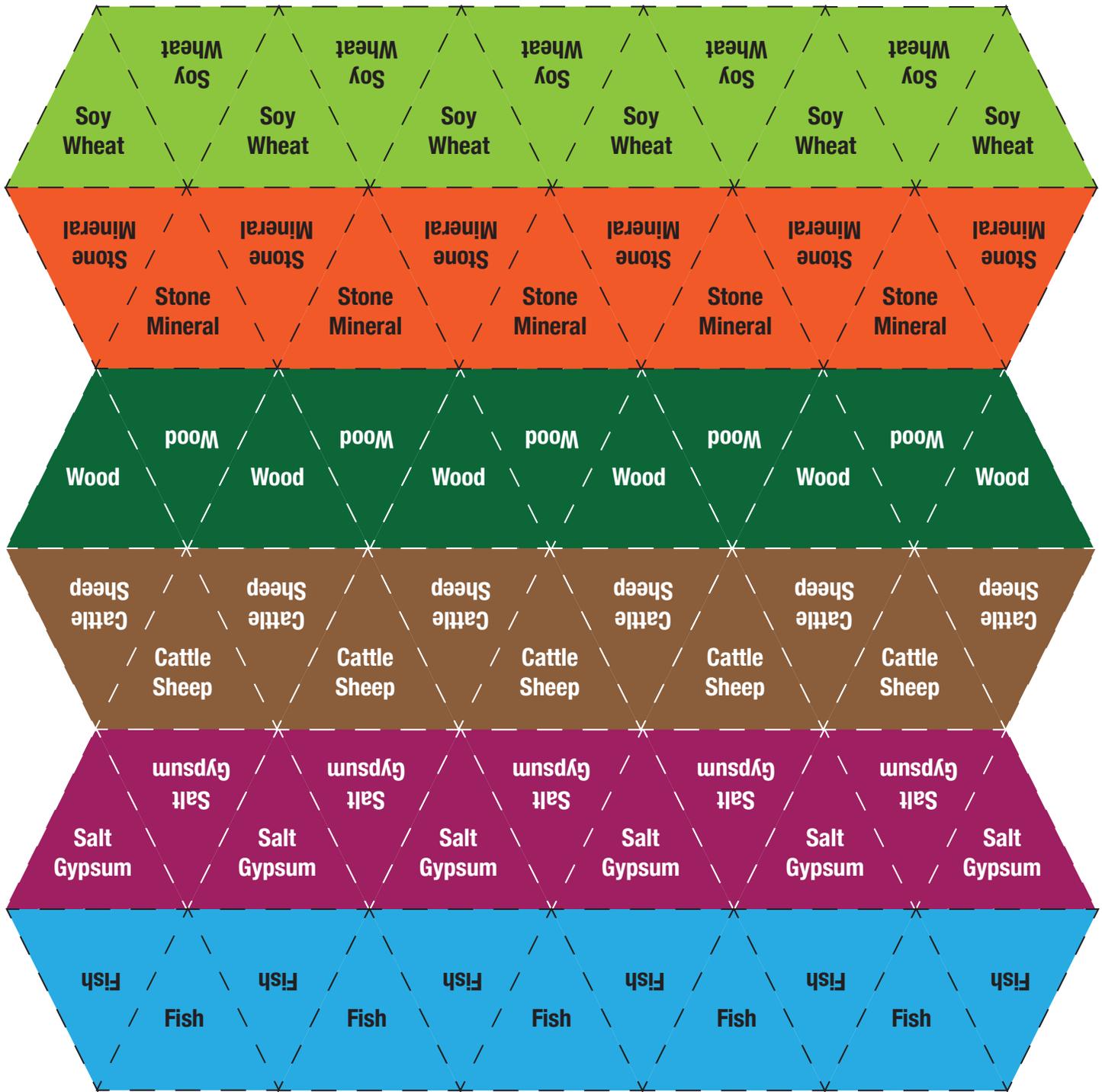
- Youngest player goes first. Each turn, a player rolls the die, moves that number of hexes, and collects ONE raw material token from the hex landed on. Players cannot land on an occupied hex or the hex they started on at the beginning of their turn.
- To earn product cards, players must land on a factory hex and trade in the raw materials required for that product. More than one product can be made on one turn. Products can be manufactured until all of the cards are gone.
- If a player rolls a 6, a disaster occurs. The player does NOT move their piece, but instead spins the Disaster Spinner. Every player must then return all Raw Material tokens of that type to the supply.
- Play continues until a player manufactures 12 points worth of products.



Manufacturing Costs - Raw Materials needed to manufacture products

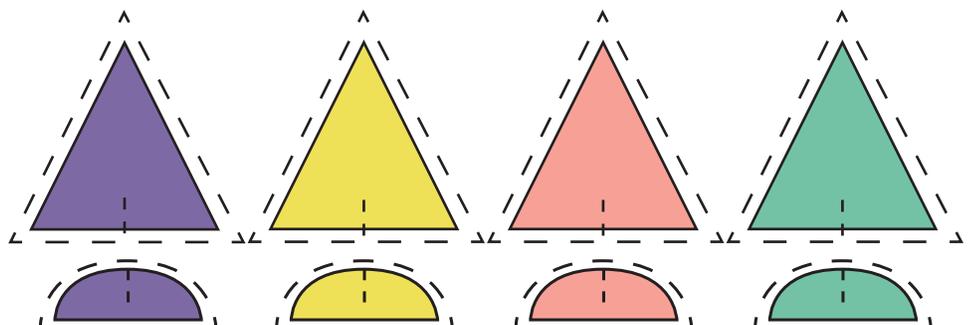
Product	Points	Materials needed			
Pencil	2	Wood	Mineral (Graphite)	Mineral (Clay)	
Playdough	2	Salt	Wheat	Wheat	
Chalk	2	Stone (Limestone)	Gypsum	Gypsum	
Crayon	3	Soy	Wood	Wood (Paper)	Mineral (Colorant)
Baseball	4	Wood (Cork)	Cattle (Cowhide)	Sheep (Wool)	Soy (Ink)
Fish sticks	4	Fish	Fish	Wheat (Flour)	Salt

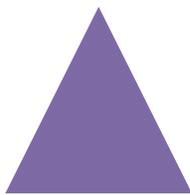
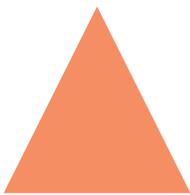
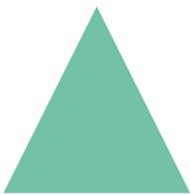
Raw Material Tokens



Player Pieces

Cut out each piece on the dashed lines. Then cut the dashed line slit on each piece and insert the stand on the bottom of the triangle.





PENCIL
2 points



PENCIL
2 points



PENCIL
2 points



PENCIL
2 points



Playdough
2 points



Playdough
2 points



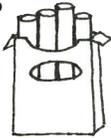
Playdough
2 points



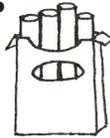
Playdough
2 points



Chalk
2 points



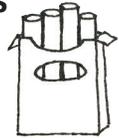
Chalk
2 points



Chalk
2 points



Chalk
2 points



Crayon
3 points



Crayon
3 points



Crayon
3 points



Crayon
3 points



Baseball
4 points



Baseball
4 points



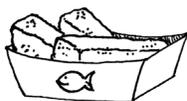
Baseball
4 points



Baseball
4 points



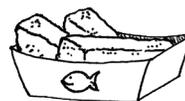
Fish Sticks
4 points



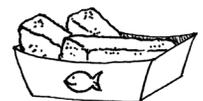
Fish Sticks
4 points



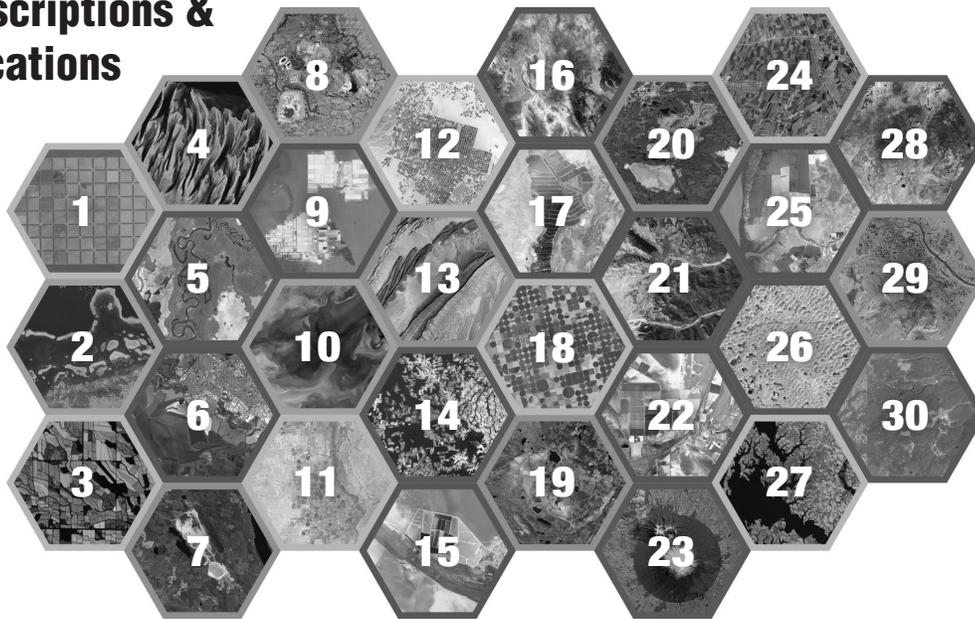
Fish Sticks
4 points



Fish Sticks
4 points



Satellite Image Descriptions & Locations



1. Northern Argentina

Areas cleared for cropland and ranging appear as a grid on the landscape in northern Argentina. *-26.239, -60.872*

2. Vanua Levu, Fiji

The waters surrounding Fiji are sources of fish such as wahoo, tuna, sailfish and marlin. *-16.337, 179.066*

3. Los Banos, California, US

Landsat and Sentinel-2 data of cropland near Los Banos, CA. Colors represent 3 periods of the 2018 growing season. *37.128, -120.630*

4. Great Bahama Bank

The shallow bank of wave-shaped ripples of sand and seagrass is next to a 2,000 meter drop that is home to more than 160 fish and coral species. *23.563, -76.443*

5. Beni River, Bolivia

The Beni River in Bolivia meanders through forests (dark green) and grassland and sparse forests (lighter green). *-12.660, -66.939*

6. San Francisco Bay, California, US

The different colors of salt ponds in San Francisco Bay are attributed to levels of salinity, different depths of water, and different types of algae and microorganisms. *37.503, -122.034*

7. British Columbia, Canada

Mount Polley Mine in Canada is an open pit copper and gold mine. *52.543, -121.632*

8. Phalaborwa, South Africa

South Africa's largest open-pit mine near Phalaborwa and Kruger National Park is the source of copper and iron. *-24.001, 31.116*

9. Salar de Atacama, Chile

Chile's Salar de Atacama has the world's largest reserve of lithium, which is a key ingredient in rechargeable batteries. *-23.547, -68.393*

10. Gulf of Mexico

Amidst the sediment suspended in the waters off the coast of Louisiana are a variety of fish including red snapper, tuna and wahoo. *28.917, -90.503*

11. Roswell, New Mexico

Landsat-derived map of water use by center pivot irrigation fields in Roswell, New Mexico. *33.188, -104.372*

12. Meegrowa, Saudi Arabia

Center pivot irrigation in desert near Meegowa, Saudi Arabia. *30.144, 38.299*

13. Atlas Mountains, Morocco

The Anti-Atlas Mountains in Morocco are rich in silver, gold, manganese, tin, cobalt, titanium, and zinc. *28.902, -8.425*

14. Mato Grasso, Brazil

Mato Grasso, Brazil has been converted from dense Amazon rainforest to pasture and agricultural lands in the last several decades. *-13.0149, -56.5796*

15. Kalahari Deser, Botswana

Makgadikgadi Pan in Botswana is one of the largest salt flats in the world and a major source for soda ash (sodium carbonate), which is used in making glass, in metallurgy, and in chemical manufacture. *-20.509, 26.078*

16. Coahuila, Mexico

A severe drought that affected Texas in 2011 produced wildfires south of the border in Mexico. *28.874, -102.882*

17. Dead Sea, Southwestern Asia

Salt evaporation ponds south of the Dead Sea are used to extract sodium chloride and potassium salts for the manufacturing of polyvinyl chloride (PVC) and other chemicals. *31.147, 35.438*

18. Garden City, Kansas, US

Common crops from these center-pivot irrigated crops near Garden City, Kansas include corn, wheat, and sorghum. *37.897, -100.949*

19. Northern Sweden

Sweden is Europe's biggest iron producer and the Kiruna mine is the largest underground iron ore mine in the world. *67.842, 20.161*

20. Negaunee, Michigan, US

Marquette Iron Range in Michigan is one of the most productive sources of iron in the United States. *46.443, -87.628*

21. Mt. St. Helens, Washington, US

Forest surrounding Mt. St. Helens is slowly growing back since the volcano's eruption in 1980. *46.191, -122.188*

22. Qarhan Playa, China

A rim of crystal salts surrounds Qarhan Salt Lake, the largest salt lake playa in China and a significant source of minerals, including table salt, potassium for fertilizer, bromine, halite, gypsum, and magnesium chloride. *36.828, 95.230*

23. Egmont Nt'I Park, Zew Zealand

Egmont National Park in New Zealand is a protected forest (dark green areas) surrounded by once-forested pasturelands (light and brown green). *-39.300, 174.065*

24. Southern Uzbekistan

Irrigated crops in southern Uzbekistan are major sources for cotton. Other crops include grains, vegetables and grapes. *37.653806, 67.123464*

25. Gujarat, India

Salt ponds near city of Bhavnagar accounts for nearly three-quarters of India's annual salt production. *21.850, 72.190*

26. Western Nebraska, US

Rangelands occupy nearly half of Nebraska's ecosystems and contribute heavily to US cattle production. *41.7650, -102.2551*

27. Eastern Maryland, US

A patchwork of croplands at various stages of harvest are visible in the rural areas around Easton, Maryland. *38.822, -75.973*

28. Utah-Nevada Border, US

In Utah, rangelands cover 80% of the land and represent diverse topography from desert canyons to mountains with lakes and streams. *37.480, -112.868*

29. Northeast Siberia

Mines around Noril'sk are Russia's major source for metals (platinum, nickel, and copper) as well as sandstone, limestone, and dolomite. *69.353, 88.188*

30. Yellowstone Nt'I Park, Wyoming, US

In the summer of 1988, wildfires tore through forests and left large burn scars across Yellowstone National Park. *44.531, -110.928*